Orthopedic Rehabilitation of the Stroke Patient

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■ *Rehabilitation of hemiplegic patients begins with setting reasonable functional goals and a treatment plan to reach them. During the initial illness an effort is made to begin range of motion exercising and positioning to prevent contractures. Transfer from bed to chair is recommended as soon as the patient's general condition permits.*

Upper extremity function depends on sensory and motor function as well as visual and central cerebral impairment. Spastic symptomatic contracture of the shoulder must be prevented by adequate orthopedic management of any musculoskeletal problems such as arthritis or tendinitis and the initiation of an active exercise program. Surgical release of contractures is occasionally indicated in refractory cases. Elbow flexion and pronation flexion deformity of the forearm and hand have also required surgical release on occasion.

The goal of lower extremity function is ambulation. A double upright short leg brace aids stability in gait. Long leg braces are not used but a cane may be necessary for balance assistance. Contractures must be prevented by an exercise program or surgically released.

PATIENTS SUFFERING WITH HEMIPLEGIA secondary to cerebrovascular accident are being seen in increasing numbers at rehabilitation centers and private facilities. Realistic goals for function and programs of treatment may not be familiar to physicians whose conventional training has been oriented toward treating acute illness. In a modern rehabilitation center, treatment is carried out by a team composed of physicians, therapists, psychologists, nurses, and social workers. There are too few of these comprehensive centers. The purpose of this article is to describe functional goals and a reasonable plan of treatment that can be offered to hemiplegic patients by a family physician and an orthopedist. The material presented is based on experience gained on the Stroke Service at Rancho Los Amigos Hospital over the last five years.

Rehabilitation should commence immediately after the occurrence of the cerebrovascular accident. It falls into two distinct phases. The initial phase begins during the period of acute illness, the second phase when the neurological

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Figure 1.—The reciprocal pulley exerciser permits patient to initiate and maintain an exercise program. The exercise regimen shown has proved valuable in the management of the contracted shoulder in the stroke patient.

hemiplegic state has been stabilized, usually about three months after the acute attack. The second stage requires a good prognosis, adequate orientation to comprehend instructions, ability to communicate, and motivation.

Initial Phase

Every effort is made to prevent flexion contractures by appropriate positioning of the patient. Rolled sheets or padding are used in the bed to prevent plantar flexion of the ankle, abnormal rotation of the hip, adduction and internal rotation of the shoulder, and an imbalanced position of the hand. The patient should be turned from back to side, as tolerated, and should also be turned into a prone position when medically acceptable to prevent hip flexion contractures. This early splinting program should be managed by regular duty nurses who are acquainted with the problems of flexion contractures and the importance of preventing pressure sores. Once a pressure sore has occurred, rehabilitation is greatly delayed. Nursing rounds should routinely include putting the patient's extremities through a range of motion several times during the day.

The patient should be taught to exercise his own extremities as soon as possible and how to use the equipment available for that purpose (Figure 1). This has the dual function of maintaining range of motion and of initiating the idea that the patient must now begin to help himself. As soon as his general condition allows, the patient should begin to transfer from bed to wheelchair. Becoming upright in a chair gives the patient a boost in morale that enables him to continue his efforts to regain independent status. It also starts an increased flow of sensory input to the central nervous system. Transfers from bed to chair require practice and assistance. The chair is rolled to the unaffected side so that the patient may use his good hand and normal peripheral vision to perform the transfer. When seated in the chair, the patient is examined for balance and support of the affected arm. An outrigger sling holding the shoulder moderately abducted has proved useful in the prevention of symptomatic adducted shoulder contractures (Figure 2).

Definitive Phase

The Upper Extremity

Major factors of impairment of the upper extremity include sensory loss, spasticity and poor motor control, occurrence of flexion contractures, and impairment of body image.

Serious sensory impairment is seen in more than half of patients with affected upper extremities. Many of these patients have adequate sensation in the shoulder, elbow and forearm, but lack position sense or discrete object identification in the hands. If a patient still shows major impairment in sensation three months after onset of hemiplegia, it is likely that the sensory defect will be permanent. No matter how much motor function the patient has in the affected hand, lack of sensation will almost invariably result in his becoming one-handed. Major treatment efforts should be directed toward making the best use of the functioning hand for the self-care and other activities of daily living rather than waste time and effort trying to teach skills that cannot be mastered with the involved hand.

Figure 2.—The outrigger sling is used to dynamically balance the weight of the arm and also allow for some maintenance of shoulder abduction in the treatment of stroke patient.

Every effort should be made to prevent painful limitation of motion in the joints of the affected extremity. Shoulder pain and restricted range of motion have been a particularly difficult problem in stroke patients. A daily program of ranging should be begun immediately. Use of reciprocal pulleys so that the good arm can help exercise the affected upper extremity has proved of value (Figure 1). The cause of shoulder pain should be be sought—bursitis, tendonitis, acromioclavicular joint arthritis, or perhaps a too enthusiastic exercise program in the presence of internal rotator spasticity, primarily in the subscapularis muscle.

If despite a therapy program the patient continues to complain of shoulder pain and demonstrates increasing spasticity in the internal rotator group, associated with decreasing range of motion, surgical intervention should be considered. Operation is contraindicated when a post-operative program is not available to the patient. One must beware of diffuse pain affecting the entire hemiplegic side that is not amenable to any form of surgical therapy. Where there is spasticity in the internal rotator muscles, relief of pain and increased range of motion have been obtained following resection of about one inch of the musculotendinous junction of the subscapularis muscle where it overlies the anterior capsule of the shoulder joint.[1]

Flexion of the elbow may become a serious problem and ultimately lead to a flexion contracture. Standing and walking usually accentuate the elbow flexion. Patients occasionally will request treatment of this contracted posture in order to improve their appearance and balance during walking. Reduction of elbow flexion can be achieved by injecting 3 percent phenol into the musculocutaneous nerve. Relief following this procedure may be temporary, however, and in some cases spasticity has returned after about six months. Elbow flexion also can be reduced by transecting the brachialis muscle or elongating the tendinous insertions of the biceps and brachialis muscles.

In association with elbow flexion, pronation of the forearm and acute flexion of the wrist and fingers frequently are seen in hemiplegic patients. Daily range-of-motion exercising should be undertaken to prevent contractures that will restrict hand function. Tight flexion of the fingers may cause pressure necrosis of the skin of the palm. Splints made from either metal or molded plastics frequently are used to maintain normal position of the wrist and fingers when there is only slight spasticity. When a patient is progressively becoming worse or has reached a functional plateau that is unacceptable because he cannot get the fingers out of the palm of his hand or his wrist out of an attitude of extreme flexion, operation may be considered. Three percent phenol injected by open operation into the median motor nerves will produce reduction of spasticity over a period of about six months.[2] This injection is used where the neurological status is changing and the orthopedist chooses to defer definitive operation.

Release of the flexor muscle origin or selective tendon lengthening procedures may improve appearance or correct contractures that limit patient hygiene. In such cases it is important to stress to the patient and his family that true functional improvement is not anticipated fol-

lowing the operation. Where there is good sensation in the forearm and hand and some evidence of selective motion underlying the acute flexion of the wrist and fingers, it is reasonable to expect improved function with flexor release.[3]

The Lower Extremity

The most common abnormality seen in the hemiplegic patient following a cerebrovascular accident is an equinovarus deformity of the ankle during the swing phase of gait. This inverted and plantar flexed attitude of the foot and ankle usually is due to spasticity in the calf muscle and an imbalance of the muscles on the dorsum of the foot (the inverters overpowering the evertors). If this imbalance is untreated, the patient may fall when attempting to walk, and restrict his activity to the wheelchair. If the muscle spasticity is of moderate severity, it usually can be corrected by using a short leg brace. Our experience at Rancho Amigo has been that a double upright brace with a limited range ankle joint is more effective in controlling spasticity and excessive pattern responses that a spring brace, which stretches the calf muscles and therefore enhances the spasticity.

In addition to controlling the equinovarus deformity, the double upright brace with the limited range ankle joint also controls ankle instability when the muscles about the ankle joint are weak (Figure 3). Proprioception impairment is another problem of the hemiplegic patient, and knowledge that the foot is in a stable neutral position greatly assists in foot placement.

Another feature of the hemiplegic is instability of the knee. Instability in either hyperextension or flexion is caused by imbalance between quadriceps and hamstrings. The double upright brace with a locked ankle joint controls the tibia and produces knee stability, which increases the ability of the patient to walk (Figure 3). When calf spasticity is severe, a double upright short leg brace is not capable of controlling the situation. Surgical intervention is indicated in such cases. Calf spasticity and plantar flexion are corrected by lengthening the Achilles tendon or by resecting the distal one-third of the soleus muscle. The imbalance between inversion and eversion of the foot is corrected by splitting the tibialis anterior tendon and transferring the lateral half into the lateral aspect of the dorsum of the foot. It has been our experience that flexion contracture of the toes becomes a problem following such operations and therefore we simultaneously transfer the toe flexors into the toe extensors during the same procedure. In our experience there is never indication for a long leg brace; knee and hip flexion contractures are corrected by muscle releases. Prevention of contractures is better than treatment and is best achieved by stimulation of antagonist muscles, appropriate range of motion, and stretching of joints by appropriate positioning.

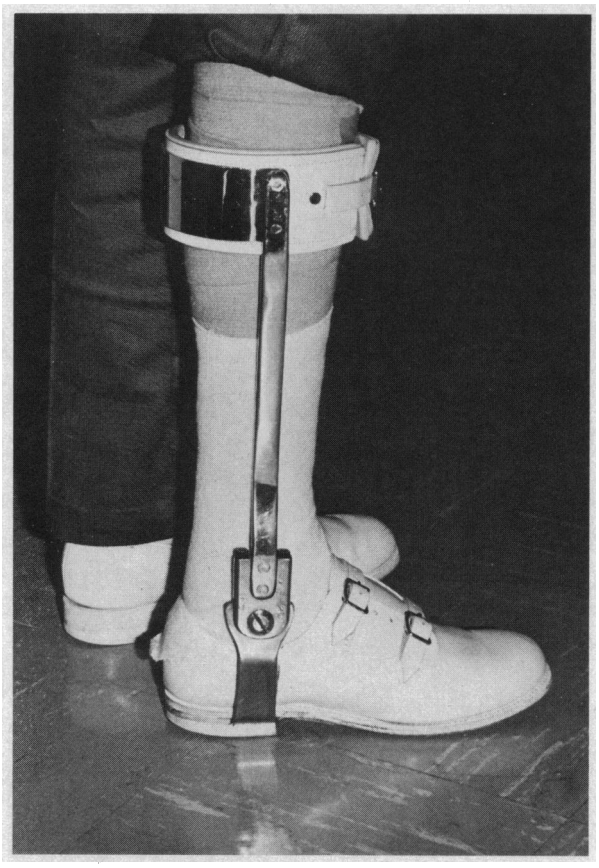

Figure 3.—The double upright brace with limited or fixed ankle provides support and proprioceptive cues for hemiplegic patients and thus assists ambulation.

Self Care

The aim of the rehabilitation program for hemiplegic patients is to allow them to achieve as much independence as is possible considering the degree of functional impairment. Patients must be evaluated for their ability to learn new skills and participate in treatment programs. This may involve psychological testing, careful evaluation of visual fields, and an analysis of the

patient's ability to communicate through gestures and speech. A program that is unrealistic as measured against the patient's capacity for recovery only frustrates the patient and disappoints the family. It therefore is essential that realistic goals be set before treatment commences. The patient must be encouraged to be as independent as possible. Also the family must be instructed in assisting him to utilize his self-care skills rather than depend on others. Special equipment, such as one-armed knives and long-handled bath sponges, are of great assistance and should be ordered as soon as possible. Discussion with the family will make apparent the need for structural alterations in the patient's home, such as the addition of ramps for wheelchair use and grab-rails by the sides of toilet and bath, and alteration of bed position so the patient can get in from his unaffected side. Such alterations should be made as soon as possible so that the patient can fit readily into his home environment.

An orthopedic program oriented toward prevention of contractures, ambulation, and maximal use of the unaffected side can be combined with a general medical and environmental adaptation program to permit the patient to rejoin society on the best possible terms. This is the goal of the orthopedic rehabilitation of the stroke patient and is best achieved by means of a multispecialty team approach.

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PLACING THE NASOTRACHEAL TUBE

To insure proper placement of the tube in blind nasotracheal intubation, I advise use of a technique of external visualization. Do not try to listen to the tube while you are aiming to get it in. Rather observe the patient's neck. Stand up and look at the neck as you advance the tube. You will find that wherever the point of the tube goes, you will be able to see its location from the outside. If it gets right into the trachea and it moves on down, you will see a little ridge move down along the midline as the point of the tube is touching the anterior wall of the trachea. If it does not enter the trachea, you will see a little shadow wherever the point of the tube is. It will be in one or two of the lateral walls of the pharynx; it may be hung up in front of the epiglottis; or it may enter the esophagus. If it's in the esophagus, you extend the head a little bit and that will bring the point of the tube up. If it's in front of the epiglottis, you flex the head a little and hold the mandible forward to get the epiglottis out of the way. If it's to one side or the other, you turn the tube so it will go in the direction you're after. With another gentle tap, the tube has been redirected and it will enter the trachea.

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